

Speed Improvements for Geolocation
Initial Considerations
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Initial runs of the Version 2 geolocation process which is part of PGE 01 have taken substantially longer time than was expected. Three recent runs, each processing 203 scans of data (one five minute granule) have taken between 35 minutes of system plus user time when done on "modular" and 40 or 48 minutes when done on MODIS-XL. Although the differences in time are not fully understood they are in part associated with whether the input and output files and the DEM file are on the same machine as the processing. In any case the time required is too long. We will be undertaking a number of steps to improve the processing efficiency of the geolocation code.

A schematic of the time profiling results accompnies this note. It shows that about 79% of the time is spent in geolocation and 21% is spent in the Land sea mask routines which were transfered to geolocation from the cloud mask for version 2.

Initial analysis of these results has identified XXX steps which we can quickly do to speed up the geolocation processing with no impact on the accuracy of the geolocation. These are:

1. Eliminate the use of IMSL matrix multiplication code in the terrain correction and position calculation routines. This is estimated to save about 25% of the total processing time. This will be done in version 2.1 which will be delivered to Test March 1, 1998. (The primary goal of version 2.1 is to incorporate the mirror encoder timing change.)
2. The ESDIS supplied DEM process currently returns a scale and offset along with every elevation value. These values are 1 and 0 for every value. We will eliminate reading and applying the scale and offset value from the geolocation code. This will save about 10% of processing time. This will also be done in the 2.1 delivery. Note that this means our software will need to be changed again if the DEM is ever changed to incorporate a scale factor and offset
3. We currently use a quick fix call to access the land-sea mask since the ESDIS toolkit call does not work. We expect that changing to use of the toolkit call, once it works, will save 5% of processing time. We expect the toolkit to be fixed prior to launch and are discussing this with ECS now.

Two more changes have also been identified which would also speed up the system with no adverse impact. However they will not be included in the immediate correction task. They are:

4. Change the access method for reading DEM data. It currently reads in one DEM tile at a time. Many scans, and often even single frames, cross DEM tile lines. This results in repeated reading of entire tiles to get single points of data. We will either cache several DEM tiles at a time or create new, substantially larger MODIS customized DEM tiles. We currently estimate a savings of 10-13% from this. This is a more complex change and will require study to identify the tradeoffs in terms of storage, processor memory use, processing efficiency, and operational impact. This work will be done after completing the Control Point matching and island control point routines. A rough estimate is that it will take four months to complete from the time we start and will be ready in the late fall.
5. The DEM currently returns terrain height as elevation above sea level. However in the deep ocean it returns a value of fill rather than 0. At present we must check each value for fill and substitute 0. A savings of 1-3 % would occur if the DEM returned 0 directly. This change would have to be made by ECS. We have not yet discussed this

with them to see if they are willing, nor do we know how long it would take them to do it.

Once these changes have been implemented we will reprofile the entire geolocation process to identify further regions of possible change. At the same time we will be profiling all of the other operational software. This will be an ongoing process which will include considerations of potential savings, time to implement, and impact on accuracy. Decisions on where to expend SDST (and in some cases Science Team) resources will be made in conjunction with all interested parties.

Note that once obvious improvements have been made there is a substantial body of experience, including results from GSFC's software engineering laboratory, that says that it is often substantially more effective to buy more hardware than it is to pursue fine scale code changes.

profile:2
Geolocation Profile results

